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Applicant: ARCHIBALD JR. ET AL.

Examiner: Thai, T.

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Technology Center 2100

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Docket No.: SJO920000056US1
IBMS.002PA

Title: METHOD AND APPARATUS FOR USING EXTENDED DISK SECTOR
FORMATTING TO ASSIST IN BACKUP AND HIERARCHICAL STORAGE
MANAGEMENT

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence and the papers, as described hereinabove, are being deposited in the United States Postal Service in triplicate, as first class mail, in an envelope addressed to: Mail Stop Appeal Brief – Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on December 19, 2003.

By: Kathleen McDevitt
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APPELLANT'S BRIEF ON APPEAL

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This Brief is presented in support of the Appeal filed September 25, 2003, from the final rejection of Claims 1-22 of the above-identified application, as set forth in the Office Action mailed March 25, 2003.

Please charge deposit account 50-0996 (IBMS.002PA) in the amount of \$330.00 for this brief in support of an appeal. Authorization is also given to charge/credit Deposit Account No. 50-0996 (IBMS.002PA) for any deficiencies/overpayments.

An original and two copies of the Brief are enclosed herewith.

Enclosed please find a Petition for Extension of Time.

I. REAL PARTY OF INTEREST

The Real Party of Interest is International Business Machines Corporation, a corporation of New York.



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II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences for the above-referenced patent application.

III. STATUS OF CLAIMS

Claims 1-22 are pending and are the subject of this Appeal (Appendix, Claims).

IV. STATUS OF AMENDMENTS

An initial Office Action was mailed on September 30, 2002. A Request For Reconsideration in response to the initial Office Action was mailed on December 30, 2002. A final Office Action was mailed on March 25, 2003. A Request for Reconsideration Amendment in response to the final Office Action was filed on May 27, 2003, under 37 C.F.R. § 1.116. An Advisory Action was mailed September 5, 2003 maintaining the rejections of the Office Action of March 25, 2003.

V. SUMMARY OF THE INVENTION

The present invention is directed to a data recording media that includes a plurality of extended format sectors, the extended format sectors comprising a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field. The backup indicator indicates whether the user data sector field has been written to. The backup indicator may also include an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field. The backup indicator field may be cleared after the user data sector field has been backed-up. By using a part of the extended sector format to include a field to indicate that the data was written since the last backup, the present invention provides an effective way of knowing which sectors have been updated by the host in order to perform an incremental backup on subsequent passes. This backup field may be a single bit or could be larger to indicate age since last backup. Of course, the present invention assumes that the physical disks have been formatted with the extended sector format so that the extra field can be included to provide the backup indicator.

VI. ISSUES PRESENTED FOR REVIEW

Issue 1:

In paragraph 4 on page 2 of the Office Action, claims 1-15 and 20-22 were rejected under 35 U.S.C. § 102(e) over Miller et al. (Note: Claims 16-19 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.)

In the Office Action of September 30, 2002, the Office Action stated "As per claims 1, 6 and 11, Miller discloses the data storage system, comprising a host computer system (e.g. see figure 1); a first set of storage volumes and a second set of storage volumes for backing-up data from the first set of storage volumes is taught by Miller as being illustrated

at column 5, line 31 bridging column 6, lines 9, especially through the concept of internal/external backup wherein Miller clearly discloses the external backups may reside on the storage 112, at a remote site, or on another location that is physically separate from the storage 112 (e.g. see figure 1); a controller for controlling the transfer of data from the host system to the first and second set of storage volumes, wherein at least the first set of storage volumes further comprises data recording media including a plurality of extended format sectors, the extended format sectors comprising a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field is taught as controller 108 which uses metadata 116 including the backup list 120, pointer set list 122, accumulator indicator 123, and update map 121 wherein the update map 121 may comprise a bit map, where each bit represents one subpart of the backup dataset, and the status of that bit indicates whether the change accumulator 130 contains any updates affecting that subpart. The change accumulator indicator 123 tells whether the backup restoration process is currently applying any change accumulator data to restored backup data; for example, the indicator 123 may comprise a flag such as a storage bit (e.g. see column 7, lines 49 et seq.); noting that the further limitation of a magnetic storage medium having servo information . . . sectors; a motor and a head assembly having at least one read head for reading and writing data on the a plurality of extended format sectors is embedded in the system of Miller and being taught to the extent that it is being claimed since different machine-readable data storage media can be utilized such as magnetic disk, RAID arrays, etc.. (e.g. see column 5, lines 14 et seq);

As per claims 2, 7 and 12, wherein the backup indicator field indicates whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation is taught by Miller as the update map 121 may comprise a bit map wherein each bit represents one subpart of the backup dataset, and the status of that bit indicates whether the change accumulator 130 contains any updates affecting that subpart (e.g. see column 7, lines 49 et seq);

As per claim 3, 8 and 13 wherein the backup indicator comprises a single bit is taught by Miller as the indicator 123 may comprise a flag such as a storage bit (e.g. see column 7, lines 56-57);

As per claim 4, 9 and 14; Miller discloses the log record is sorted according to the datasets that each log record corresponds to then by attributes such as data, time, . . . within each dataset (e.g. see column 8, lines 34 et seq.);

As per claims 5, 10 and 15; Miller discloses wherein the backup indicator indicates whether the user data sector field has been written to (e.g. see column 7, lines 49 et seq.);

As per claims 20-22, they encompass the same scope of invention as to that of claims 1-5, 6-10 and 11-15 except they are drafted as method format rather than apparatus format, the claims are therefore rejected for the same reasons as being set forth above."

VII. GROUPING OF CLAIMS

For the purpose of the present appeal, in considering the rejections, the claims can be grouped as follows:

- Group 1: Claims 1, 6, 11, and 20;
- Group 2 Claims 2, 5, 7, 10, 12 and 15;
- Group 3 Claims 3, 8 and 13;
- Group 4 Claims 4, 9 and 14; and
- Group 5 Claims 21-22.

As noted above, Claims 16-19 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims

VIII. ARGUMENT

I. Issue 1

1. CLAIMS 1, 6, 11 AND 20 WERE REJECTED UNDER §102(e) OVER MILLER et al.

a. MILLER FAILS TO TEACH, DISCLOSE OR SUGGEST ALL OF THE CLAIM LIMITATIONS RECITED IN CLAIMS 1, 6, 11 AND 20

Appellants' invention requires data recording media comprising a plurality of extended format sectors. Thus, the present invention requires that the recording media has been formatted with the extended sector format. The extended format sectors include a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field. The backup indicator field is used to indicate whether user data in the user data sector field has been written to backup storage subsequent to a previous backup operation. Thus, Appellants' invention provides an effective way of knowing which sectors have been updated by the host in order to perform an incremental backup on subsequent passes without reference to a separate log of metadata kept by the host or the controller.

In contrast, Miller does not provide extended sector formatted media. Rather, Miller provides a change log containing metadata concerning changes to an original dataset received by the system after creating a backup dataset. According to Miller, if any changes to the primary data are received by the system after creating the backup data, the changes are stored by the system in a change log. Change logs may be consolidated and sorted.

However, Miller does not even mention extended formatting as illustrated with reference to Fig. 5 in Appellants' specification. Further, Miller does not suggest providing a physical disk format larger than the host data format. Moreover, Miller fails to suggest providing recording media with extended format sectors that includes a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field as recited in Appellants' independent claims 1, 6, 11 and 20.

Therefore, in view of the above remarks, Appellants' independent claims 1, 6, 11 and 20 are patentable over Miller.

Because claims 2-5, 7-10, 12-19 and 21-22 depend from independent claims 1, 6, 11 and 20, respectively, include the features recited in the independent claims as well as

additional features, Appellants respectfully submit that claims 2-5, 7-10, 12-19 and 21-22 are also patentably distinct over the cited reference. Nevertheless, Appellants are not conceding the correctness of the Examiner's rejection with respect to such dependent claims and reserves the right to make additional arguments if necessary.

b. MILLER FAILS TO TEACH, DISCLOSE OR SUGGEST ALL OF THE CLAIM LIMITATIONS RECITED IN CLAIMS 2, 5, 7, 10, 12 AND 15.

For the reasons stated above related to independent claims 1, 6, 11 and 20 and for the reasons that follow, claims 2, 5, 7, 10, 12 and 15 are patentable over Miller.

Claim 5 from the instant application requires the elements of claim 1 and at least that “the backup indicator indicates whether the user data sector field has been written to,” where the backup indicator is found in the data recording media. Both the user data sector field and the backup indicator are contained on the extended format sectors. To access the user data sector's data the system merely looks within the extended format sector of the data recording field where the backup indicator is located.

First, Miller fails to suggest providing recording media with extended format sectors that includes a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field as discussed above. Moreover, Miller does not disclose a backup indicator that indicates whether the user data sector field has been written to. Miller states at column 7, lines 49 et seq. “the update map 121 may comprise a bit map, where each bit represents one subpart of the backup dataset, and the status of that bit indicates whether the change accumulator 130 contains any updates affecting that subpart.”

However, the updated bit data in the update map 121 is on metadata 116 separate from storage units 114. Further, the update map 121 merely contains an indicator of whether the change accumulator 130 contains any updates. This can easily be seen with reference to Fig. 1, wherein in order to access updates in Miller the change accumulator 130 must be accessed via the communications channel 110 which is separate from metadata 116 and storage units 114.

Thus, Miller does not teach, disclose or suggest, “the backup indicator indicates whether the user data sector field has been written to” where the backup indicator is found on extended format sectors.

Therefore, in view of the above remarks, Appellants’ dependent claims 2, 5, 7, 10, 12 and 15 are patentable over Miller.

c. MILLER FAILS TO TEACH, DISCLOSE OR SUGGEST ALL OF THE CLAIM LIMITATIONS RECITED IN CLAIMS 3, 8 AND 13.

For the reasons stated above and for the following reasons, claims 3, 8 and 13 are patentable over Miller.

With respect to claim 3, Appellants’ invention requires all the elements of claim 1 and at least that “the backup indicator comprises a single bit.” Viewing the single bit backup indicator on the extended format sector of the data recording media indicates the status of the user data sector field.

As discussed above, Miller does not teach, disclose or suggest all of the elements of claim 1. Moreover, Miller does not teach, disclose or suggest at least that “the backup indicator comprises a single bit” from claim 3. In Miller the change accumulator indicator 123 “tells whether the backup restoration process is currently applying any change accumulator data to restored backup data. As an example, the indicator 123 may comprise a flag such as a single bit” (see column 7, lines 54-55).

Thus, the single bit change accumulator indicator in Miller indicates when the restore process is taking place and does not teach, disclose or suggest the elements of the instant application that a backup indicator comprising a single bit indicates the status of a specific user data sector field on the extended format sector that it corresponds to.

Therefore, in view of the above remarks, Appellants’ dependent claims 3, 8 and 13 are patentable over Miller.

d. MILLER FAILS TO TEACH, DISCLOSE OR SUGGEST ALL OF THE CLAIM LIMITATIONS RECITED IN CLAIMS 4, 9 AND 14.

For the reasons stated above related to independent claims 1, 6, 11 and 20 and for the reasons that follow, claims 4, 9 and 14 are patentable over Miller.

Claim 4 from the instant application requires all of the limitations of claim 1 and at least that “the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field.” The age of the user data in the user data sector field can be determined by assessing the extended format sector backup indicator.

As discussed above, Miller does not teach, disclose or suggest all of the elements of claim 1. However, Miller also fails to teach, disclose or suggest at least that “the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field.”

In contrast, Miller states at column 8, lines 34 et seq. that “log records 132 may be sorted first according to the datasets that each log record corresponds to, then by attributes such as date, time, etc., within each dataset.” Further, Miller does not teach, disclose or suggest, “the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation.” Rather, Miller discloses at column 9, lines 37-42, “[w]hen step 714 detects that the storage controller 108 has finished applying contents of the change accumulator to the restored backup data, the storage controller 108 clears the accumulator indicator 123 and the update map 121(step 715). At this time, having updated the backup data with the accumulated log records, the change accumulator 130 is also cleared.”

Thus, Miller does not mention anything about indicating whether a field has been written to backup storage subsequent to a previous backup operation because the accumulator indicator, update map, and change accumulator are all cleared once a backup operation is performed, and thus removing any data about whether a previous backup operation was performed.

Moreover, viewing a log record alone is insufficient in Miller to determine “the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field” from the

instant application. Log records in Miller are collected by the storage controller 108 (column 8, lines 5-6), sorted multiple times (see column 8, lines 29-37), step 608 “merges the sorted log records with previously constructed contents (if any) of the change accumulator 130” (see column 8, lines 41-45), the merged contents are then used to modify “the update map 121 to reflect the log records newly added to the change accumulator 130” (see column 8, lines 54-56). In Miller log records found on metadata are separate from storage units. Thus, sorted log records sorted by attributes such as date or time in Miller are not equivalent to a backup indicator that alone and without further sorting or processing has the capability of “indicating the age of the user data in the user data sector field” on data recording media from the instant application.

Therefore, in view of the above remarks, Appellants’ dependent claims 4, 9 and 14 are patentable over Miller.

e. MILLER FAILS TO TEACH, DISCLOSE OR SUGGEST ALL OF THE CLAIM LIMITATIONS RECITED IN CLAIMS 21 AND 22.

For the reasons stated above related to independent claims 1, 6, 11 and 20 and for the reasons that follow, claims 21-22 are patentable over Miller.

With respect to claim 21, Appellants’ application requires the method of claim 20 and “clearing the backup indicator field after the user data sector field has been backed-up.” When each sector is read subsequent to clearing the backup indicator field for a specific user data sector field, the previously backed-up user data sector field is not repeatedly backed-up.

As discussed above, Miller does not teach, disclose or suggest all of the elements of claim 20. However, Miller also fails to teach, disclose or suggest at least clearing the backup indicator field after the user data sector field has been backed-up. Rather, Miller states that “when step 714 detects that the storage controller 108 has finished applying contents of the change accumulator to the restored backup data, the storage controller 108 clears the accumulator indicator 123 and the update map 121” (see column 9, lines 37-40). The accumulator indicator, as described above in part c, indicates whether the backup process is taking place with no indication of which data sector is being backed-up. Thus, the accumulator indicator is cleared only after all of the contents of the change accumulator have

been applied to the restored backup data without regard to which individual user data sector field has been backed-up.

Therefore, in view of the above remarks, Appellants' dependent claims 21-22 are patentable over Miller.

SUMMARY

For the foregoing reasons, it is submitted that the Examiner's rejections of the claims and objection to the specification were erroneous, reversal of his decision is respectfully requested, and allowance of all of the pending claims is requested.

Respectfully submitted,

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Date: December 19, 2003

By: 

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APPENDIX

THE CLAIMS ON APPEAL

WHAT IS CLAIMED IS:

1. A data recording media comprising a plurality of extended format sectors, the extended format sectors comprising a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field.
2. The data recording media of claim 1 wherein the backup indicator field indicates whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation.
3. The data recording media of claim 1 wherein the backup indicator comprises a single bit.
4. The data recording media of claim 1 wherein the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field.
5. The data recording media of claim 1 wherein the backup indicator indicates whether the user data sector field has been written to.

6. A data storage system, comprising:
- a magnetic storage medium having servo information recorded on servo tracks interspersed between a plurality of extended format sectors;
 - a motor for moving the magnetic storage medium relative to a magnetic head assembly; and
 - a head assembly having at least one read head for reading and writing data on the a plurality of extended format sectors;
- wherein the extended format sectors further comprises:
- a user data sector field for storing user data; and
 - a backup indicator field for indicating the status of the user data sector field.
7. The data storage system of claim 6 wherein the backup indicator field indicates whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation.
8. The data storage system of claim 6 wherein the backup indicator comprises a single bit.
9. The data storage system of claim 6 wherein the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field.
10. The data storage system of claim 6 wherein the backup indicator indicates whether the user data sector field has been written to.

11. A data storage system, comprising:

- a host computer system;
- a first set of storage volumes;
- a second set of storage volumes for backing-up data from the first set of storage volumes; and

a controller for controlling the transfer of data from the host system to the first and second set of storage volumes, wherein at least the first set of storage volumes further comprises data recording media including a plurality of extended format sectors, the extended format sectors comprising a user data sector field for storing user data and a backup indicator field for indicating the status of the user data sector field.

12. The data storage system of claim 11 wherein the backup indicator field indicates whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation.

13. The data storage system of claim 11 wherein the backup indicator comprises a single bit.

14. The data storage system of claim 11 wherein the backup indicator comprises an indicator of whether the user data in the user data sector field has been written to backup storage subsequent to a previous backup operation and data indicating the age of the user data in the user data sector field.

15. The data storage system of claim 11 wherein the backup indicator indicates whether the user data sector field has been written to.

16. The data storage system of claim 12 wherein the first set of storage volumes is arranged as a virtual space wherein the host views the configuration as being a storage device having a first predetermined size and the controller allocates storage space from the first set of storage volumes having a physically smaller size than viewed by the host.

17. The data storage system of claim 16 wherein the controller periodically determines which sectors have been written using the backup indicator to predict when the host will need additional physical space.

18. The data storage system of claim 16 wherein the controller allocates additional storage space on the first set of storage volumes before the host requires additional storage space to minimize delays to the host.

19. The data storage system of claim 18 wherein the controller reads the backup indicator to determine when a usage threshold have been exceeded.

20. A method for tracking the status of writes to areas of a storage device, comprising:

- a) initializing a storage system and clearing a backup indicator field in an extended format sector used for indicating the status of a user data sector field of the extended format sector;
- b) setting the backup indicator when a host writes to a user data sector field; and
- c) reading every sector included in a host user area of the system drive and backing-up only user data sector field in the extended format sectors having the backup indicator field set.

21. The method of claim 20 further comprising:

- d) clearing the backup indicator field after the user data sector field has been backed-up.

22. The method of claim 21 further comprising repeating b)-d) for each subsequent backup.